reply to Prof. Vines' citation of the parthenogenetic fungi, that not only sexual forms may vary into new species.

It is to the last essay, that on "Amphimixis, or the essential Meaning of Conjugation and Sexual Reproduction," that most attention will be directed Here there is a full statement, with important additions and alterations of the central part of Dr. Weismann's theories. However they may bulk in public imagining, questions of acquired characters, of retrogressive metamorphosis, and so forth, are side issues of a search for the morphological expression of the processes of variation.

Originally Weismann explained the two successive divisions of the nucleus of an unfertilized egg which form the two polar bodies as, in the case of the first, an extrusion of that nuclear plasm which, having served to guide the maturation of the egg, became useless when the egg was mature; and in the case of the second, as a halving of the nuclear substance to make way for the incoming sperm-plasm.

In parthenogenetic ova, one division and only one was predicted and found. It was suggested that parallel processes occur in spermatogenesis.

Subsequent research by O. Hertwig and others has brought to light these parallel processes, and Weismann, seeking for a sign, got rather more than he anticipated. For the processes in spermatogenesis show first a doubling of the germ-plasma, and then two successive reducing divisions, and it has been shown that exactly this happens in ova also. Accordingly, Weismann rejects his original explanation of the first polar body as an extrusion of ovo-genetic nucleoplasm, and the new problem comes to be, what is the cause of that doubling of the nucleoplasm which in primitive sperm and germ cells precedes the two reducing divisions?

Weismann supposes that the ancestral plasms or units of heredity, to which he gives the name "ids," are arranged in "idants," or nuclear rods. The doubling process takes place normally by longitudinal division, and simply doubles the number of idants without altering the arrangement of "ids." By this method the number of possible combinations is increased without alteration of the ids. The process is a mechanical one to increase the chances of combinations when the idants of sperm and germ cells meet. If the idants were coloured rods, to be arranged in pairs—say black, white, red, and yellow for four sperm idants, and orange, green, blue, and crimson for those of the egg-cell—obviously only four pairs are possible. The black would have to unite with one of the four others. But if before the arrangement in pairs each rod were split in two, there could be two combinations for black, and so on for the others. No doubt in many cases the number of idants is far greater than four, and the mechanical arrangement for variations correspondingly greater. From the large number of possible combinations there come the relative few individuals of the next generation, and there is thus a basis for the lawless and apparently capricious appearance of varieties. Next in importance comes Dr. Weismann's belief, based on theoretical considerations, and supported by experiments on *Cypris*, conducted for seven years, that in parthenogenetic reproduction heritable variations may occur. But they are far less frequent than in sexual reproduction. But the whole of this essay is full of intricate and curious speculation, speculation which will have to come before every student of biology, and which, whether much or little of it becomes incorporated in the body of accepted knowledge, will at least play a large part in guiding and stimulating present research.

P. C. M.

ELEMENTARY CHEMISTRY.

The Standard Course of Elementary Chemistry. By E. J. Cox, F.C.S. Pp. 344. (London: Edward Arnold.)

THIS book consists of five parts, which may be obtained separately or bound up in one volume. It is based upon the syllabus prescribed by the Education Department for teaching chemistry as a class or specific subject, and professes to lead the beginner from the "familiar" to the "less known" by means of "investigation," the teaching thus afforded being regarded as a branch of mental education as well as of useful knowledge. The five parts deal respectively with the properties of the common gases, the atmosphere, water, carbon and non-metallic elements, and with metallic bodies, combination, symbols and formulæ.

The general plan of the book and the manner in which the subject is approached, have a good deal to recommend them; the detailed treatment contains, however, much which could be improved, and unfortunately much which the learner will have to forget as he progresses in the study of his science. In the opening chapter, evidently for the sake of simplicity, the author uses the term heat in place of temperature. More confusion on the subject of heat is made later on by the use of equations, such as

$$\text{“}\left.\begin{array}{c}\textit{Chalk}\\ \text{and}\\ \textit{Heat}\end{array}\right\}\text{ yield }\left\{\begin{array}{c}\textit{Lime}\\ \text{and}\\ \textit{Carbonic Acid Gas.”}\end{array}\right.$$

which appears to attribute to heat a material existence; and even more unsatisfactory are bald statements to the effect that "no heat is produced in the formation of a mixture. Heat is produced in the formation of a chemical compound."

Considerable space is occupied in the comparison of the affinities of the elements. Because certain metallic oxides, including iron-oxide, are reduced when heated in a stream of hydrogen, the affinities of the metals for oxygen are said to be weaker than that of hydrogen for oxygen. In the case of iron and steam the author has to note that the inverse change—the oxidation of the metal by steam—readily occurs, and that the former statement as to the affinities of iron and hydrogen for oxygen, is apparently contradicted. This contradiction might have indicated the futility of attempting to compare affinities in a general way and not with reference to the special conditions under which the experiments were performed. The inverse change in the case of iron is said to occur when the "temperature" is favourable, but in reality the active masses of the reacting materials determine the direction of the change.

Inaccurate statements are numerous. Hydrogen is said to form "one-third part of water by volume," "a formula" is stated to "represent a molecule," and a base is given as "a compound of a metal with hydrogen and

© 1892 Nature Publishing Group

oxygen." More objectionable still are occasional instances of bogus reasoning, the most striking example being an erroneous proof of the conservation of mass. On three different occasions the indestructibility of matter is stated to be a consequence of the law of definite proportions. Almost equally bewildering is an attempt to show that "a molecule occupies two volumes," an attempt which even when correctly carried out might well be excluded from a book which professes to discourage anything akin to cramming. No advance is made in familiarizing the learner with accurate conceptions of atom and molecule; indeed the need for the latter conception in chemical philosophy is quite overlooked.

Throughout the book the author's mode of expressing himself is frequently not the happiest. To say that "air allows all bodies that will to take fire in it," or that "chlorine does not combine with an excess of hydrogen" is harmless enough perhaps. On the other hand to talk of the "properties of a mixture" being the "sum of the properties of its constituents," or of the gas being kept dissolved in a bottle of soda water "by the pressure of the cork," or to say that "water has weight and exerts pressure" cannot but be puzzling to the intelligent reader.

To prepare a thoroughly good introduction, of the most elementary kind, to the study of chemistry, is a work of considerable difficulty, indeed it is one which few of our leading chemists seem desirous of undertaking. Enough we think has been quoted from the book under notice to show that the author has by far underrated the difficulty of this task. J. W. R.

LIFE AND DEATH.

Essai sur la Vie et la Mort. Par Armand Sabatier. (Paris: Babé et Cie.)

PROF. SABATIER'S "Essai sur la Vie et la Mort" forms the fourth volume of the "Bibliothèque Évolutioniste," a series of books published under the direction of M. de Varigny, with the view of expounding in a strictly scientific manner the different principles and the diverse applications of the theory of Evolution. The series most appropriately begins with a translation of Wallace's "Darwinism," and it is gratifying to our national pride to find that the two other works which have as yet appeared in the series, Ball's "Treatise on Use and Disuse," and Geddes' and Thomson's "Evolution of Sex," as well as the two others announced as in the press, are all by British authors.

The present essay, which extends over 280 pp., is the outcome of a series of lectures delivered at the University of Montpellier. It is written in a clear, simple style, devoid for the most part of all technicalities which appeal only to the specialist. The problems of life and death are dealt with from an exclusively biological point of view, and questions of morality and theology are hardly touched upon. It is difficult to do justice to the views expounded in the book in the short space at our disposal, but an attempt may be made to give a short account of its contents. The first part deals with life: the properties of living matter are considered in great detail, and Prof. Sabatier endeavours to show that the attributes of life are found to some extent, at any rate, in dead matter. According to his views "la matière brute est vivante aussi," but the manifestations are slow and dull. To the Professor's mind living matter and dead matter are not absolutely distinct: between the two states of matter there is only a difference of degree and not of kind. "La vie donc est partout, dans la matière dite inanimée comme dans la matière vivante." The various features in which dead matter behaves like living, are considered at great length; but, curiously enough, no mention is made of Bütschli's remarkable experiments on artificial amœbæ, recently described in the "Quarterly Journal of Microscopical Science."

This view being accepted, death in the ordinary sense of the word, naturally cannot exist, and the phenomenon which we usually call death becomes but another form of life—"la vie intense" simply passes into the state of "la vie lente." Immortality, according to our author, consists in the indefinite continuity of life ("la vie intense") without arrest or interruption. Like Weismann, he maintains that the negation or the contrary of such immortality involves the presence of a dead body or corpse. Weismann holds that ciliated infusoria are immortal if kept under favourable conditions, these conditions, of course, including frequent opportunities of conjugating. Sabatier considers that such infusoria are only potentially immortal, and that the act of conjugation converts this potentiality into a real immortality. In his opinion the primitive protoplasm was immortal, and the habit of dying has been acquired by the higher organisms in response to two stimuli, one internal and one outside themselves. The internal cause of death is associated with a tendency innate in the living being to improve its position in the world, in response to which it has become more specialized, and developed new organs and powers. This specialization has borne with it the seeds of death. The external cause is the surrounding world, which constantly stimulates and promotes the organism to new efforts, and in the struggle for the mastery death is brought about.

Although we fail to see that Prof. Sabatier has thrown any new light upon the problems he attempts to solve, and although the explanations he advances seem to us inadequate, his book is a useful one, inasmuch as he gives us a careful summary of the numerous views advanced by various writers in the last twenty-five years, on the subject of life and death, and criticises with considerable ability the theories of Weismann, Goette, Minot, &c. In fact, his destructive powers seem greater than his constructive. A. E. S.

OUR BOOK SHELF.

Contagious Foot Rot in Sheep. By Prof. G. T. Brown, C.B., 16 pp., 8 illustrations, (John Murray).

THIS pamphlet is a reprint from the second part of the current volume of the Royal Agricultural Society's Journal. A few additional remarks on the prevention of foot rot have been added, and if the instructions given were fully carried out, the disease would soon cease to be troublesome. The preventive suggestions are (1) separation from the rest of the flock for one month of all animals newly purchased; and (2) isolation of all animals affected.

In discussing the treatment of the disease, Prof. Brown

© 1892 Nature Publishing Group